CLAIMS:

1. An apparatus for replacing at least a portion of an intervertebral disc in a spinal column, comprising:

a first member having a first vertebral contact surface for engagement with an endplate of a first vertebral bone in the spinal column, and having a first articulation surface that is defined at least by a concave arc having a radius of curvature A about a first axis substantially perpendicular to an anterior-posterior plane of the spinal column, and by a convex arc having a radius of curvature B about a first axis substantially perpendicular to a lateral plane of the spinal column; and

a second member having a second vertebral contact surface for engagement with an endplate of a second vertebral bone in the spinal column, and having a second articulation surface that is defined at least by a convex arc having a radius of curvature C about a second axis substantially perpendicular to the anterior-posterior plane of the spinal column, and by a concave arc having a radius of curvature D about a second axis substantially perpendicular to the lateral plane of the spinal column, wherein:

an intervertebral disc space is defined substantially between the first and second endplates of the first and second vertebral bones, and

the radii of curvature of the first and second articulation surfaces are sized such that the first and second articulation surfaces engage one another when the first and second members are disposed in the intervertebral disc space to enable the first and second vertebral bones to articulate in at least one of flexion, extension and lateral bending.

2. The apparatus of claim 1, wherein at least one of: (i) the first and second axes perpendicular to the anterior-posterior plane of the spinal column are substantially coaxial; and (ii) the first and second axes perpendicular to the lateral plane of the spinal column are substantially coaxial.

3. The apparatus of claim 1, wherein at least one of: (i) the first and second axes perpendicular to the anterior-posterior plane of the spinal column lie in a plane that is substantially perpendicular to the anterior-posterior plane; and (ii) the first and second axes

perpendicular to the lateral plane of the spinal column lie in a plane that is substantially perpendicular to the lateral plane.

4. The apparatus of claim 1, wherein the first and second articulation surfaces are sized and shaped to define at least one of: (i) a first center of rotation for at least one of flexion and extension that is located outside the intervertebral disc space, and (ii) a second center of rotation for lateral bending that is located outside the intervertebral disc space.

5. The apparatus of claim 4, wherein the first center of rotation is located outside the intervertebral disc space in one direction and the second center of rotation is located outside the vertebral disc space in a substantially opposite direction.

6. The apparatus of claim 1, wherein the first and second articulation surfaces are sized and shaped to engage one another when the first and second members are disposed in the intervertebral disc space to enable the first and second vertebral bones to at least axially rotate relative to one another through a range of angles.

7. The apparatus of claim 1, wherein the first and second articulation surfaces are sized and shaped to engage one another when the first and second members are disposed in the intervertebral disc space to enable the first and second vertebral bones to axially rotate relative to one another through a range of angles without substantially displacing the first and second vertebral bones away from one another.

8. The apparatus of claim 7, wherein the first and second articulation surfaces are sized and shaped to achieve substantial point-to-point contact relative to one another when in at least some positions of flexion, extension, lateral bending, and/or axial rotation.

9. The apparatus of claim 7, wherein the range of angles is about plus/minus three degrees from a resting position.

10. The apparatus of claim 7, wherein the first and second articulation surfaces are sized and shaped such that the first and second vertebral bones are displaced away from one another at axial rotations outside the range of angles.

11. The apparatus of claim 1, wherein the radius A of the concave arc is greater than the radius C of the convex arc in order to permit axial rotation of the first and second articulation surfaces relative to one another.

12. The apparatus of claim 1, wherein the radius D of the concave arc is greater than the radius B of the convex arc in order to permit axial rotation of the first and second articulation surfaces relative to one another.

13. The apparatus of claim 1, wherein the radius A of the concave arc is about 0.329 inches, the radius B of the convex arc is about 0.340 inches, the radius C of the convex arc is about 0.280 inches, and the radius D of the concave arc is about 0.401 inches.

14. The apparatus of claim 1, wherein the first member further includes an anterior flange including at least one through hole for receiving a bone screw.

15. The apparatus of claim 1, wherein the second member further includes an anterior flange including at least one through hole for receiving a bone screw.

16. The apparatus of claim 1, wherein the first and second members each further include an anterior flange including at least one through hole for receiving a bone screw.

17. The apparatus of claim 16, wherein the anterior flange of one of the first and second members includes at least two through holes for receiving bone screws.